



Sound



**Dolphin
Science
Book 8**

CHARLES D. NEAL

Dolphin Science Books are for children from six to nine years old. They have been carefully edited by a team of educationalists, who have made sure that the writing is clear and informative, and the subject matter and vocabulary exactly suited to the age group. The books are illustrated at every page opening with pictures and labelled diagrams in full colour.

What makes **sounds**? How do they travel? Why are some sounds high and some sounds low? How does sound help us? These and many other questions are answered in this book.

Dolphin Science Books

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2033

5167



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Science Editor

Kenneth Laybourn, Ph.D., M.Sc. Deputy Education Officer,
Manchester

Educational Consultants

Harry Armstrong Headmaster, Carr Mill County Primary
School, St Helens, Lancashire

Boswell Taylor Formerly Headmaster, Lyndon Green
Junior School, Birmingham



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Charles D. Neal

Illustrated by Janet LaSalle



University of London Press Limited, Warwick Lane, London E.C.4

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Sounds are all around us.

There are sounds all through the day. There are sounds all through the night.

Sounds are made in different ways and by different things.

People talking make sounds.

Animals make sounds.

Cars and aeroplanes make sounds.

There are a great many different kinds of sounds.





But in one way all sounds are the same. They are all made by things moving backwards and forwards very fast. When things move backwards and forwards very fast, we say that they vibrate.

Stretch a rubber band over a box. When you pluck the rubber band, you will hear and see it vibrate.

There are many ways of making things vibrate. For example, we can pluck them, hit them, scrape them, or blow on them.

We pluck the strings of a banjo. We hit a drum. We blow through our lips when we whistle. The wind blows on leaves and makes them vibrate.





Sound travels in waves. Sound waves are rather like water waves. They travel in all directions from the place where they start.

Throw a pebble into a pond. Or dip your finger in and out of your bath water. The movement of your finger makes water waves that travel in all directions.

When things vibrate, they make sound waves.



Sound waves need something to travel through.

Sound waves can travel through things like air, water, earth, wood and metal. Things like this are called sound conductors.

Water and metal are good sound conductors. On cold days, the sound of tapping on a radiator travels down through the metal pipes. It tells the caretaker to send up more heat.

Without conductors, sound could not travel. Without conductors, we could not hear sounds.



In air, molecules are far apart.



In wood, molecules are close together.



Sound travels in much the same way through different sound conductors.

Everything around us is made up of very tiny bits, or particles. These bits are so tiny that we cannot see them with our eyes. Scientists call these tiny bits molecules.

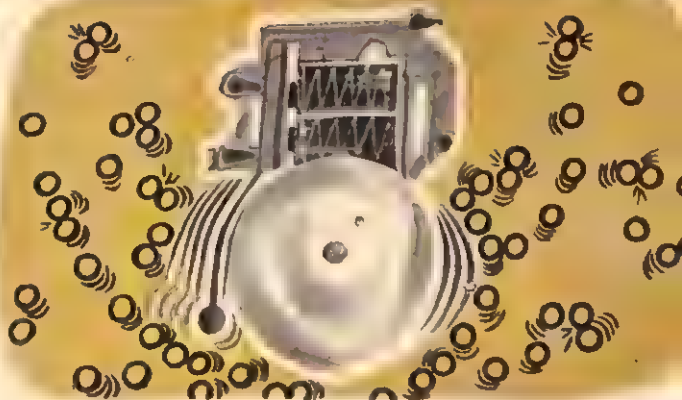
In solids, like metal and wood, the molecules are very close together. In liquids, like water, the molecules are farther apart. In gases, like air, the molecules are very far apart.

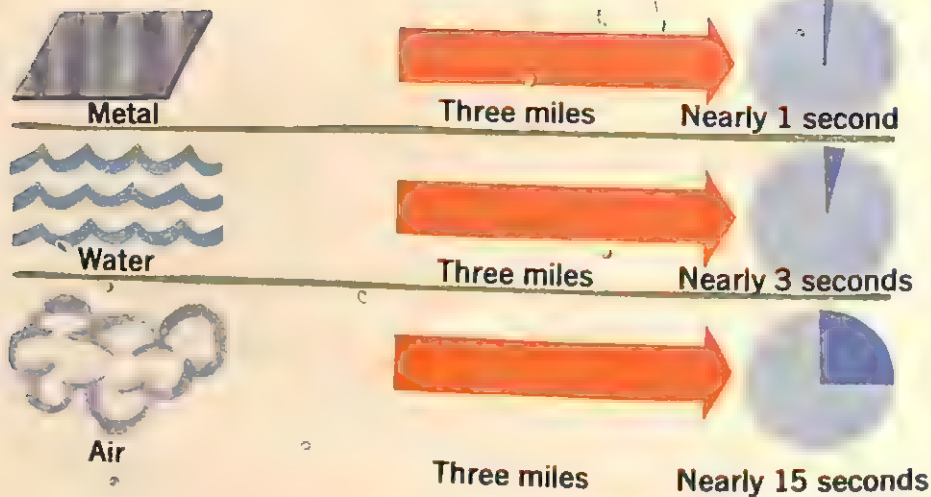
When a bell rings, first the clapper hits the bell. This makes the metal of the bell vibrate.

The vibrating metal hits the molecules of air round it and makes them vibrate too. Then the molecules bump into other molecules and start these molecules vibrating.

This goes on and on. Molecules keep bumping into more molecules. All of them are made to vibrate more than before.

In this way the sound of a bell is carried from molecule to molecule. The movement travels in all directions as sound waves.



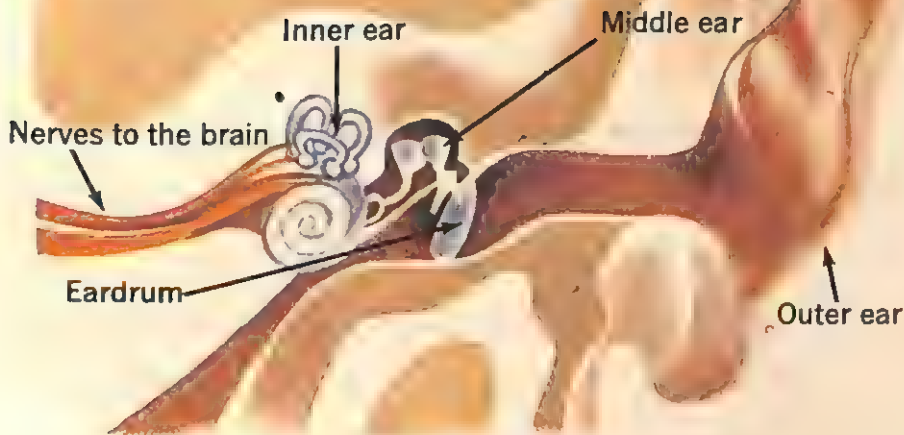


Sound travels fastest in solids, such as metal and wood. The molecules are very close together in solids. They can carry the sound vibrations quickly.

Sound travels more slowly in liquids, like water. The molecules are farther apart. They cannot carry the sound vibrations as quickly.

Sound travels more slowly in gases, like air. The molecules are very far apart and carry the sound vibrations more slowly.

Sound could not travel at all if there were no molecules to carry the vibrations.



We hear sounds with our ears. When things vibrate, the outer ear catches some of the sound waves.

- These sound waves travel to the eardrum. They hit the eardrum and make it vibrate, too.

The moving eardrum makes three little bones in the middle ear vibrate. The sound waves made by these vibrations travel to nerves in the inner ear. The nerves carry the sound message to the brain.

If we want to hear better, we must find a way of catching more sound waves than our outer ear can catch.

One way to catch more sound waves is to put your hand to your ear like a cup.

Or if a sound is too loud, you may cover your ears with your hands. This stops some of the sound.



Some animals have large outer ears. Large outer ears are a great help in hearing sounds of danger.

The rabbit is an animal that has large outer ears. Its large outer ears let the rabbit catch more sound waves.

This helps the rabbit to know when an enemy is near.



Some animals can hear much better than people can. They can hear sounds that people cannot hear at all.

There are whistles that are made especially to call dogs.

The sound of the whistle is too high for people to hear. But dogs can hear it.

This whistle is very useful for policemen and for other people who work with dogs.





Sounds are different in many ways.

For example, some of them are high, and some of them are low.

High sounds are made by things that vibrate very quickly. The more quickly we make things vibrate, the higher the sound will be.

The pea in a whistle and the striker of a telephone bell vibrate very fast. They make high sounds.



Low sounds are made by things that vibrate more slowly. The more slowly we make things vibrate, the lower the sound will be.

A drum vibrates slowly. It makes low sounds. Far-away thunder makes low sounds. The air here vibrates slowly.

The highness or lowness of a sound is called the pitch.



Some sounds are loud. Other sounds are soft. The harder we hit a drum, the louder the sound will be. The sound waves are strong.

If we hit the drum gently, the sound will be softer. The sound waves are weak.

Loudness and softness of a sound is called intensity. Intensity has nothing to do with the highness and lowness of a sound. Sounds of the same pitch can be louder or softer.

Sound waves get weaker as they travel. This makes the sound softer.

When you are near something that is making a sound, the sound may be loud and strong.

When you are far away, the sound will be softer and weaker.

When someone is speaking close by, the sound may seem loud. But the same sound may seem soft if the person who speaks stands farther away.





• Play one note on the piano. Now sing the same note.

• The two sounds can be just as high and just as strong. But they will seem different to you. You can easily tell the difference.

We say there is a difference in the quality of the two sounds. Everything that makes a sound will give its own quality to the sound.

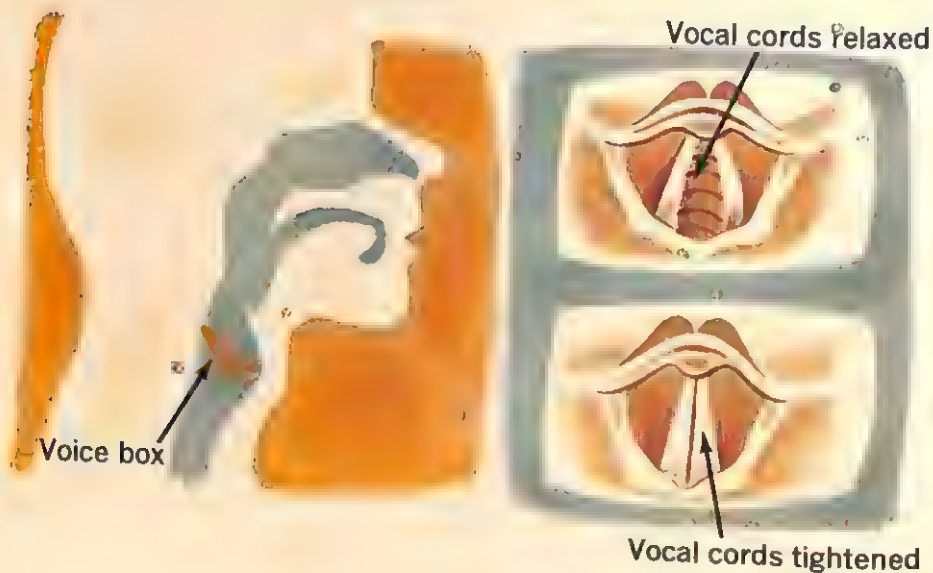


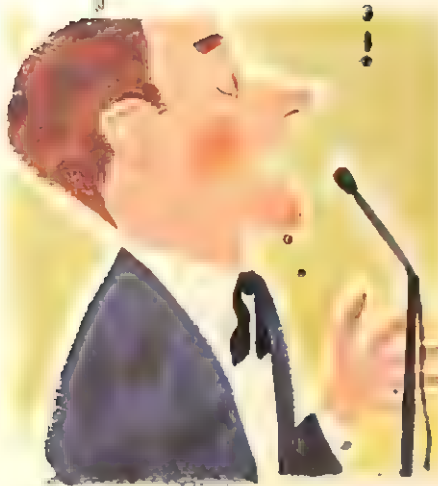
People talk and sing and make other sounds by making their vocal cords vibrate.

The vocal cords are strong bands inside the voice box. All the air that we breathe in or out passes through the voice box. When we talk or sing, messages are sent from the brain to the muscles that control the vocal cords.

The cords tighten. Air is forced out of the lungs and over the vocal cords. They vibrate.

As the vocal cords are made tighter or looser, they make different sounds.





Sounds can be preserved so that we can hear them again and again. We keep sounds on tape recordings and gramophone records.

In making a record, the sounds are used to make a needle vibrate, and the needle cuts a tiny groove in a turning disc.

When we play a record, the gramophone needle vibrates as it follows the tiny groove in the records. The sounds made by the vibrating needle are just the same sounds that were made by the singer.

When sound waves hit a big hard wall, they will bounce back. Sometimes they bounce back to make an echo. An echo lets us hear the same sound again.

To make an echo, we must stand more than 55 feet from the wall. If we are closer than that, the sound waves bounce back so soon that the sound and the echo seem to be the same.

If we are somewhere with hills or mountains all round, we can make many echoes at the same time. We can shout a word once and hear it come back to us again and again.





Men on ships use echoes to learn about things under the water. The method they use is called echo-sounding.

- An echo-sounding machine on a ship sends out sound waves towards the bottom of the sea. By the echoes that bounce back, seamen can tell how deep the water is. Or fishermen can tell where a great many fish are swimming.

They can tell these things by noticing the time it takes for the echo to bounce back.



The little animals called bats have a built-in echo-sounding machine. Bats have a very good sense of hearing. Because of this they can fly in the dark.

Bats make very high sounds, so high that people cannot hear them. The waves from these sounds hit things in the bat's path. The echoes bounce back to the bat's ears.

The echoes let the bat know which way to turn to keep from hitting things.



Sometimes the ringing of telephones or the sound of machines is too loud. People cannot do their work well. They cannot sleep.

- To deaden sound, we use materials like felt and rubber and cork. We use soft materials in our rooms like rugs and curtains.

Sounds do not bounce back from these materials, and they are bad conductors of sound as well.



Though sometimes we want less sound, we still need sound for almost everything we do.

A factory siren tells people when to come to work. The bell on a fire engine clears the road ahead.

A foghorn warns ships away from rocks.

We use alarm clocks to wake us in the morning.
We use sound in many ways all day.

Many sounds add beauty to the world.
Birds like thrushes and blackbirds sing
beautiful songs.

Many people can play beautiful music on
the piano or violin.

These are all beautiful sounds. There are
hundreds of other sounds that add beauty to
the world.



Things you can do

Experiments with vibrations. If you have a toy drum or tom-tom, beat the drum and press your fingertips lightly on the head of the drum. You will hear the sound and at the same time feel the vibrations as the skin moves backwards and forwards very rapidly. Crush some cornflakes, or other dry breakfast cereal, and scatter them on top of the drum. Now beat the drum. You will see the tiny flakes bounce up and down as the skin of the drum vibrates.

Borrow a tuning fork from your music teacher. She will show you how to strike the tuning fork to make it vibrate. The prongs of the tuning fork will vibrate so rapidly that all you will see is a blur. But you will hear the sound that the tuning fork makes. You can show that a tuning fork makes vibrations. First strike the tuning fork, then quickly touch the prongs to the surface of some water. The vibrations of the prongs will make the water sprinkle. Strike the tuning fork again, but this time touch the prongs lightly to a sheet of paper held in your hand. The vibrations will make the paper rattle.

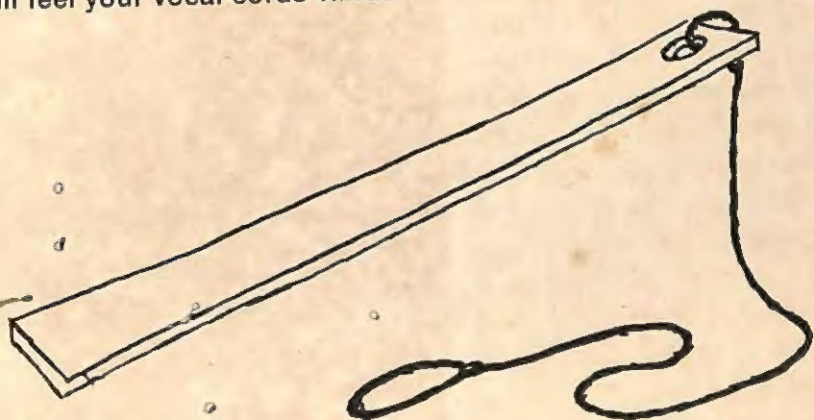
Some experiments that show how sound travels. Borrow your father's garden hose. Stretch the hose out in a straight line. Say something into one end of the hose while your friend listens at the other end. Your friend will hear everything that you say very well. This experiment shows two things. First, sound can travel very well in air. Second, you can hear sounds better if you catch all the sounds and send them straight to your ear.

Stand at one end of a long table and tell your friend to stand at the other end. Now scratch the table top very lightly with your fingernail. Your friend will not hear the sound. Then tell your friend to put his ear against the edge of the table top. Scratch the table top again very lightly. Your friend will hear the sound now. Sounds travel better in solids than in air.

The next time you go swimming in summer, try this. Knock two bits of rock together in the air and ask a friend to listen to the sound

that the rocks make. Now knock the rocks together under the water and make your friend duck his head into the water and again listen to the sound that the rocks make. The sound will be louder in the water. This happens because sound travels better in water than in air.

Experiment with high and low sounds. Hold one end of a rubber band between your teeth. Stretch the rubber band with one hand and pluck the band with the fingers of the other hand. The rubber band will vibrate backwards and forwards rapidly and make a sound. The tighter you pull on the rubber band, the higher the sound will be. You can make sounds with your voice in this way. Air passes across your vocal cords and makes them vibrate. The tighter the muscles make your vocal cords, the faster they vibrate and the higher the sound will be. Put your thumb on one side of your throat. Now sing a high note, or scream if you want to. You will feel your vocal cords vibrate.



Make a "singing" stick. Take a thin 12-inch ruler or a piece of wood the same size. Make a hole in one end and tie a piece of string to the hole. Now swing the stick in a circle. The stick will vibrate and sing. The harder you swing, the more the stick will vibrate, and the higher and louder the stick will sing.

Words younger children may need help with

(Numbers refer to the pages on which the word first appears)

- | | | |
|--------------|---------------|----------------|
| 5 sounds | 13 outer | 21 piano |
| 6 forwards | eardrum | quality |
| vibrate | middle | 22 vocal cords |
| stretch | nerves | breathe |
| pluck | inner | messages |
| 7 scrape | brain | muscles |
| banjo | 15 enemy | 23 preserved |
| whistle | 16 especially | recordings |
| 8 waves | 17 striker | gramophone |
| directions | different | groove |
| pebble | telephone(s) | disc |
| 9 metal | 18 highness | 24 bounce |
| conductors | lowness | echo |
| caretaker | pitch | 25 method |
| 10 particles | 19 gently | echo-sounding |
| scientists | loudness | machine |
| molecules | softness | 27 materials |
| solids | intensity | 29 thrushes |
| liquids | | blackbirds |
| gases | | violin |



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- 2 **Magnets** Edward Victor
- 3 **Space** Marian Tellander
- 4 **Your Body** Robert J. R. Follett
- 5 **Machines** Edward Victor
- 6 **Plants with Seeds** Dorothy Wood
- 7 **Rocks and Minerals** Lou Williams Page
- 8 **Sound** Charles D. Neal
- 9 **Air** Edna Mitchell Preston
- 10 **Frogs and Toads**
Charles A. Schoenknecht
- 11 **Mammals** Esther K. Meeks
- 12 **Whales** Val Gendron and David A. McGill

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